

SECTION 20 20 13
PIPE SLEEVES, SUPPORTS, AND ANCHORS FOR FACILITY SERVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pipe sleeve.
- B. Pipe hangers, supports, and guides.
- C. Anchors and anchorage devices.
- D. Seismic requirements.

1.02 RELATED SECTIONS

- A. Section 01 33 00 – Submittal Procedures
- B. Section 01 33 23 – Shop Drawings, Product Data, and Samples
- C. Section 05 05 22 – Metal Welding
- D. Section 05 50 00 – Metal Fabrications
- E. Section 20 10 13 – Common Materials and Methods for Facility Services
- F. Section 20 30 13 – Vibration Isolation and Seismic Control for Facility Services

1.03 MEASUREMENT AND PAYMENT

- A. Separate measurement or payment will not be made for the work required under this Section. All costs in connection with the Work specified herein will be considered to be included or incidental to the Work of this Contract.

1.04 REFERENCES

- A. American Society of Mechanical Engineers (ASME):
 - 1. ASME B31.1 Power Piping
 - 2. ASME B31.2 Fuel Gas Piping
 - 3. ASME B31.9 Building Service Piping Code
 - 4. ASME B36.10 Welded and Seamless Wrought Steel Pipe
- B. American Society for Testing and Materials (ASTM):
 - 1. ASTM A36/A36M Specification for Carbon Structural Steel
 - 2. ASTM A53 Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated Welded and Seamless

3. ASTM A74 Specification for Cast Iron Soil Pipe Fittings
 4. ASTM A153/A153M Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
 5. ASTM A307 Specification for Carbon Steel Bolts and Studs, 60 000 psi Tensile Strength
 6. ASTM A449 Specification for Quenched and Tempered Steel Bolts and Studs
 7. ASTM A563 Specification for Carbon and Alloy Steel Nuts
 8. ASTM F708 Practice for Design and Installation of Rigid Pipe Hangers
- C. Federal Specifications (FS):
1. FF S 325 Shield, Expansion; Nail, Expansion; and Nail, Drive Screw (Devices, Anchoring, Masonry)
 2. WW H 171 Hangers and Supports, Pipe
- D. Manufacturers Standardization Society (MSS):
1. MSS SP-58 Pipe Hangers (Clevis Type) and Supports – Materials, Design and Manufacture
 2. MSS SP-69 Pipe Hangers (Clevis Type) and Supports – Selection and Application
 3. MSS SP-89 Pipe Hangers (Clevis Type) and Supports – Fabrication and Installation Practices
- E. National Fire Protection Association (NFPA):
1. NFPA 13 Installation of Sprinkler Systems
 2. NFPA 14 Installation of Standpipe and Hose Systems
- F. State of California, Department of Transportation (Caltrans):
1. Standard Specifications, Section 75, Miscellaneous Metal
- G. Sheet Metal and Air Conditioning Contractor's National Association, Inc. (SMACNA):
1. Seismic Restraint Manual Guidelines for Mechanical Systems
- H. Underwriters Laboratories Inc. (UL):
1. UL 203 Pipe Hanger Equipment for Fire Protection Service
 2. UL 1479 Fire Tests of Through-Penetration Firestops

1.05 REGULATORY REQUIREMENTS

- A. Refer to Section 20 10 13, Common Materials and Methods for Facility Services – Fire Suppression, Plumbing and HVAC, for requirements.

1.06 SUBMITTALS

- A. Refer to Section 01 33 00, Submittal Procedures, and Section 01 33 23, Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Submit Shop Drawings and manufacturers' product data of pipe sleeves, pipe supports, and anchorage devices. Show detailed dimensions and description of materials and parts on drawings or cuts.

1.07 QUALITY ASSURANCE

- A. Requirements:
 - 1. Welding Qualifications: Qualify welding processes and welding operators in accordance with Section 05 05 22, Metal Welding.
 - a. Certify each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
 - 2. Reference Standards: Comply with applicable requirements of the herein listed reference standards.
 - 3. Regulatory Requirements: Comply with California Plumbing Code pertaining to product materials and installation of supports and anchors.
 - 4. NFPA Compliance: Hangers, Clevis Type only, and supports shall comply with NFPA 13 and NFPA 14 including Appendices when used as a component of a fire protection system.
 - 5. Seismic Conditions: Calculations of seismic loading shall be in accordance with the SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
- B. Criteria for Selection of Pipe Sleeves:
 - 1. Sleeves Through Interior Walls, Floors, and Ceilings: Provide galvanized steel pipe sleeves with welded steel plate anchors.
 - 2. Sleeves Through Exterior Below Grade Walls, Floors, and Ceilings:
 - a. Sleeves More Than 15 Feet Below Grade: Provide cast iron sleeves with compression seals.
 - b. Sleeves 15 Feet or Less Below Grade: Provide steel sleeve with modular link seals.

3. Sleeves Through Exterior Above Grade Roofs: Provide one of the following:
 - a. Lead flashing sleeve or copper sleeve with skirt.
 - b. Cast iron sleeve with flashing clamp device, pressure ring, and accessories.

C. Criteria for Pipe Supports, Hangers, Guides, and Anchors:

1. Provide hot dipped galvanized steel clevis type pipe hangers and supports suitable for the usage in accordance with these specifications.
2. Provide pipe hangers and supports suitable for the indicated usage in accordance with FS WW-H-171.
3. Provide pipe hangers of same size, or nearest manufactured size available, as pipe or tubing for which they shall be used, except for insulated piping as specified below.
4. Hangers and supports shall support weight of five times the water filled pipe plus 250 pounds, fluid and pipe insulation, plus the weight of valve and fitting action on the pipe.
5. Provide pipe guides to prevent horizontal or vertical displacement of piping.
6. Provide anchors and support piping and as specified, including seismic restraints.

D. Criteria for Location of Pipe Supports and Hangers:

1. Vertical spacing: Guide and support vertical piping in the center of each riser, but not over 10 feet on centers, unless otherwise indicated, and at the base of the riser on a base elbow or tee with pipe stand. Provide riser clamp in accordance with FS WW H 171 and MSS SP-69, type eight (note spacing at each landing in stairwells). For uninsulated copper pipe or tubing, use nonferrous or electrolytically coated steel compatible hangers for the riser clamp.
2. Horizontal spacing:
 - a. Provide maximum hanger and support spacing, on centers, for horizontal piping as follows, unless indicated otherwise:

Type of Pipe	Pipe Diameter		
	3/4 in. or smaller	1 in. thru 1-1/4 in.	1-1/2 in. or larger
Steel pipe	8 ft.	10 ft.	10 ft.
Copper tubing	5 ft.	8 ft.	10 ft.
Cast iron pipe in 5 ft. lengths			5 ft.
Cast iron pipe in 10 ft. lengths			10 ft.

- b. Place a hanger close to point of change of direction of a pipe in either a horizontal or vertical plane.

3. Place supports and hangers for cast iron soil pipe as close as possible to joints and, when hangers or supports do not come within one foot of a branch line fitting, install an additional hanger or support at fitting.
 4. Supports for fire protection piping shall comply with applicable NFPA requirements.
- E. Allowable Deviation from Accepted Location: Locate pipe sleeves and pipe support and anchorage devices not more than 1/2 inch from locations indicated on reviewed and accepted Shop Drawings.

1.08 SITE CONDITIONS

- A. Do not drill, cut, burn, or weld structural members in connection with the installation of pipe supports, bracing, and anchorage devices, unless proposed in writing and approved by the Engineer.

PART 2 PRODUCTS

2.01 PIPE SLEEVES

- A. Sleeves Through Interior Walls, Floors, and Ceilings:
1. Sleeves: Pipe shall be standard weight conforming with ASTM A53 or ASME B36.10. Steel plate anchor conforming with ASTM A36/A36M shall be welded to pipe. The assembly shall be hot dip galvanized after fabrication.
 2. Fire Rated Packing: Where pipes pass through fire rated walls, floors, or ceilings, provide UL listed through penetration fire stop material meeting UL 1479 to seal the opening between the pipe and pipe sleeve and maintain the fire rating.
 3. Escutcheons:
 - a. Public Areas: Solid plate stainless steel with satin finish.
 - b. Non-Public Areas: Split ring chrome plated with set screws.
 - c. Size: Minimum one inch annulus shall be provided except at building seismic joints. Building seismic joint pipe sleeves shall be minimum of 5 inches greater than the nominal diameter of the pipe.
- B. Sleeves Through Exterior Below Grade Walls, Floors, and Ceilings:
1. Sleeves more than 15 feet below grade: Cast iron, ASTM A74, pressure sealing with membrane clamp; cast iron body with external fins, internal steel compression rings and nitrile rubber grommets, and pressure clamp with 18 8 stainless steel bolt. Sealing members shall provide electrical isolation between carrier pipe and all metallic components of sleeve including membrane and pressure clamps.
 2. Sleeves 15 feet or less below grade: Steel pipe sleeve, ASTM A53, pressure sealing with membrane clamp ring, gasket, water stop ring, external rings, nitrile rubber link seals. The assembly shall be hot-dip galvanized after fabrication.

- a. Seals: Modular mechanical type seals, consisting of interlocking nitrile rubber links shaped to continuously fill the annular space between the pipe and the sleeve and electrically isolate the carrier pipe from the steel sleeve.
 - b. Sealing Element: Polychloroprene rubber material compounded to resist aging, ozone, sunlight, hydrocarbon gases, water, and chemical action.
 - c. Hardware: type 300 series stainless steel fasteners. Threads rolled to produce smooth uniform threads and unbroken flow lines.
 - d. Compression Plates: Fiberglass-reinforced polyester plastic, injection molded for high physical properties, dielectric strength and non cold flow creep characteristics, having high resistance to acidic and alkaline soils.
- C. Sleeves Through Exterior Above Grade Roofs: Provide one of the following flashing types as applicable to installation conditions:
- 1. Lead flashing sleeve weighing four pounds per square foot, or copper sleeve weighing 16 ounces per square foot, suitably framed with skirt extending not less than 8 inches.
 - 2. Cast iron sleeve with calking recess, anchor lugs, flashing clamp device, and pressure ring with brass bolts.

2.02 PIPE HANGERS, SUPPORTS, AND GUIDES

- A. Provide pipe hangers, pipe supports, and pipe guides hot dip galvanized unless otherwise indicated. Provide copper-plated hangers for uninsulated copper rigid tubing. Provide felt lined hangers or felt or elastomeric wrap on uninsulated copper rigid tubing.
- B. Hangers and support components shall be factory-fabricated materials designed and fabricated in accordance with MSS SP-89, MSS SP-58, and MSS SP-69.
 - 1. Components shall have hot dipped galvanized coating; electroplate is not acceptable.
 - 2. Pipe hangers and supports shall have non-metallic felt or elastomeric liner or wrap applied to the pipe for electrolytic protection where hangers and supports are used to support copper tubing or pipe. The liner or wrap shall be designed to allow expansion or contraction of the piping.
 - 3. Strap type hangers shall not be used on any piping system; use only clevis type. The clevis hanger fastener nuts shall be nylon lock type or the standard nut threads shall be coated with a District approved adhesive; untreated nuts are not allowed to be used.
 - 4. Band type or strap type hangers (MSS 5, 7, 9, and 10) shall not be used on any piping system.
- C. Provide hot dipped galvanized steel pipe alignment guides, factory fabricated of cast semi-steel or heavy steel and consisting of a two-section bolted outer cylinder and base with two-section guiding spider that bolts tightly to the pipe. Length of guides shall be as recommended by manufacturer to allow 6 inch minimum travel in either direction.

- D. Anchors for equipment, duct and pipe hangers and supports shall be either of the following types as applicable to installation condition:
1. Cast in Place; Hot dipped galvanized metal inserts or anchor bolts cast into the concrete at time of placing.
 2. Post installed; Where inserts or anchor bolts are omitted, post-installed anchor bolts may be used subject to limitations below;
 - a. All post-installed anchor bolts shall have International Code Council, ICC, evaluation/approval documentation and be either hot dip galvanized or stainless steel for exterior use conditions.
 - b. All post-installed anchor bolts shall be installed in accordance with manufacturer's instructions.
 - c. Only mechanical anchors shall be used in support of sustained tension load conditions.
 - d. Where there is presence of train induced vibration and air pressure, or support of vibratory equipment, undercut anchor or anchors with documented fatigue test report shall be used.
 - e. All drop-in anchor bolts are prohibited.

E. Types of Hangers:

1. Hangers for Cold Pipe: Carbon steel, adjustable, clevis.
2. Hangers for Hot Pipe Sizes 2 to 4 inches: Carbon steel, adjustable, clevis (MSS type 1).
3. Hangers for Hot Pipe Sizes 6 inches and Larger: Adjustable steel yoke, cast iron roll clevis (MSS type 1, 36, 38, 40, 41, 43-46 or 49).
4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
5. Vertical Support: Steel riser clamp (MSS type 3, 4, or 8).
6. Copper rigid tubing Support: Carbon steel rings, adjustable, copper plated (MSS type 6).
7. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded. Connections to threaded rod shall be double nutted.
8. Inserts: Malleable iron case or galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms. Size inserts to suit threaded hanger rods.

2.03 ANCHORS AND ANCHORAGE DEVICES

- A. Anchors and Bolts: Bolts and studs, shall conform with A260 or A493, as applicable. Nuts shall conform to ASTM F524 and washers shall conform to ASTM A240, A260 or 493 as applicable. Bolts and studs, nuts and washers shall be AISI type 316 stainless steel.

- B. Fasteners and Accessories: Provide anchors and fasteners, washers, straps, and accessories required for a complete and finished installation. Fasteners shall be AISI Type 316 stainless steel.
- C. Expansion Bolts: Where anchors are not included in the concrete or masonry construction, anchors shall be AISI type 316 stainless steel screws or bolts with expansion-shield type concrete or masonry anchors, of sizes and types indicated or required. Obtain District approval through the Engineer for use of drilled expansion-type anchors before using them in the Work.

2.04 SEISMIC REQUIREMENTS

- A. Seismic restraints, anchorages and reinforcements shall be provided for all piping. Equipment and piping shall be anchored to withstand forces generated by earthquake movement.
- B. All piping shall be seismic braced, as a minimum as follows:
 - 1. At all changes in direction provide transverse and longitudinal braces.
 - 2. Provide transverse braces maximum of 40 feet on center.
 - 3. Provide longitudinal braces maximum of 80 feet on center.
 - 4. Provide lateral bracing at all end of line sprinklers.
- C. Braces shall consist of components specifically designed for intended service, galvanized (except pipe hanger in contact with copper rigid tubing) and complete with galvanized pipe chord member.
- D. For piping suspended or supported on trapeze, clamp pipes rigidly to trapeze and brace trapeze in accordance with NFPA 13 requirements, or use engineered system. All material shall be galvanized or stainless steel.
- E. The use of wire , rope, strap, chain, wood or similar make shift devise is prohibited. The use of restraint system is prohibited.

PART 3 EXECUTION

3.01 REQUIREMENTS

- A. Install pipe sleeves, pipe supports, guides, and anchorage devices where indicated or required.
- B. Examine substrates and conditions where supports and anchors are to be installed. Do not proceed with installation until unsatisfactory conditions have been corrected.
- C. Rigidly secure pipe sleeves, pipe supports, guides, and anchorage devices against displacement by concrete placement operations.
- D. Protect pipe, valve, hydrants, equipment, etc. from damage from vehicles, trains, etc. As a minimum provide ballard protection where necessary.

3.02 INSTALLATION OF PIPE SLEEVES

A. General Requirements:

1. Provide a pipe sleeve where each pipe passes through an exterior or interior wall, floor, ceiling, or roof, and at other locations indicated.
2. Set pipe sleeves parallel to the pipes that pass through them.
3. Do not install sleeves in structural members except where indicated or approved.
4. Secure sleeves to concrete forms to prevent displacement during placing of concrete.

B. Sleeves Through Interior Walls, Floors, and Ceilings:

1. Install permanent sleeves of steel pipe with steel plate anchors.
2. Where specified sleeves cannot be installed, such as at connections to floor drains, provide sleeves modified to suit installation conditions.
3. Do not allow sleeves or pipe to be in contact with reinforcing steel.
4. Cut pipe sleeves through walls flush with the finished wall surfaces. Sleeves through interior floors shall project 3 inches above and below the finished floor.
5. Provide minimum of 1-inch annulus (radial clearance between pipe or pipe plus insulation or coating) to accommodate installation of seal.
6. Where pipes pass through fire rated walls, floors, and ceilings, install linked, preformed double silicone seals with zinc plated pressure plate and bolts. Caulk both sides with UL listed fire seal (expansion foam) fire rated penetration seals in the opening between the pipe and pipe sleeve.
7. Where pipes pass through non fire rated walls, floors, and ceilings, provide lined, preformed EPDM seal with Type 316 plate bolts and pressure plate.

C. Sleeves Through Exterior Below Grade Walls, Floors, and Ceilings:

1. Sleeves more than 15 feet below grade:
 - a. Install a cast iron sleeve with compression seals.
 - b. Install the sleeve assembly and seals so that there is complete electrical isolation between the carrier pipe and all metallic components of the sleeve including membrane and pressure clamps.
2. Sleeves 15 feet or less below grade:
 - a. Install a steel sleeve with modular link seals.
 - b. Seal the annular space between the sleeve and pipe with insulating type modular link seals. Assemble the links loosely with bolts to form a continuous rubber belt around the pipe with a compression plate under each bolt head and nut. After the seal assembly is positioned in the sleeve, tighten the bolts so that the sealing elements

expand providing electrical isolation between the pipe and sleeve and a hydrostatic seal.

3. Provide sufficient radial clearance beyond pipe, or pipe plus coating, to accommodate installation of sealing elements.
4. Extend exterior coating on buried piping flush with exterior surface of sealing element at outer membrane clamp.
5. Calking or other types of mastic or lead and oakum joints are not acceptable for exterior below grade penetrations.

- D. Sleeves Through Exterior Above Grade Roofs: Install copper flashing sleeves, or cast iron sleeves in accordance with manufacturer's instructions.

3.03 INSTALLATION OF PIPE HANGERS AND SUPPORTS

- A. Requirements: Provide above ground piping systems inside and outside buildings with anchorages, sway braces, guides, supports, and seismic protection. Support components shall be compatible. Hangers and supports for piping systems shall include the following requirements:

1. The necessary hangers and supports, including beam and purlin clamps, rods, pipe rolls, angles, channels and plates, and any changes from indicated design, shall be approved by the Engineer before installation.
2. Use of building structural steel for supporting hangers will not be permitted unless indicated or approved by the Engineer. Refer to Article entitled "Installation of Anchors" herein for prohibition of drilled anchors in post-tensioned decks.
3. Support vertical piping with approved steel brackets to prevent swaying, sagging, vibration, and resonance; however, allow for thermal expansion between supports or anchors.
4. The use of wire, rope, strap, chain, wood, or similar makeshift devices is prohibited.
5. Hose faucets, compressed air outlets, and similar fixtures at ends of pipe branches shall be supported within 3 inches.
6. Supporting structures, including supporting frames, anchors, and guides common to mechanical work and electrical work, may be used at Contractor's option, unless otherwise indicated.
7. When piping to equipment is mounted on vibration isolators, provide spring cushion or other approved type isolation hanger on the nearest pipe support and on each side of the equipment.
8. Except as otherwise noted, use clevis type hangers for all pipe sizes. The clevis hanger fastener nuts shall be nylon lock type or the standard nut threads shall be coated with a District approved adhesive; untreated nuts are not allowed to be used. Where copper tubing is directly supported, use copper plated hangers.

9. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
10. Provide field fabricated, heavy-duty steel trapezes fabricated from steel shapes selected for loads required and welded in accordance with applicable requirements of Section 05 05 22, Metal Welding.
11. Support fire protection systems piping independently from other piping systems.
12. Provide lateral bracing at end of line sprinklers. Restraint system is prohibited.

B. Supports for Insulated Piping:

1. For insulated hot and cold water lines, unless otherwise indicated, use insulation inserts as required for supporting piping from exterior of insulation.
2. Pipe less than 2 inches may be supported from insulation with galvanized steel half round protective shields.
3. For vertical piping 4 inches and larger, provide angle or plate type insulation supports welded to pipe at approximately 12 foot intervals. Fabricate these supports of same material as pipe that they are attached to, and of widths less than thickness of insulation covering.
4. Install hangers around outside of low temperature insulation. Insert section of one inch long by 180 degree cellular glass, minimum eight pounds per cubic foot density, with vapor barrier jacket plus 18 gage by 10 inch by 180 degree galvanized steel shield. Special hangers equipped with equivalent insulating material and vapor barrier may be used.

C. Supports for Embedded Piping: Provide supports for piping to be embedded in concrete.

3.04 INSTALLATION OF ANCHORS

- A. Anchors and anchorage devices shall be accurately located and installed to template furnished by the equipment manufacturer.
- B. Provide all bolt heads and nuts with washers.
- C. Expansion bolts shall be installed in snug fitting smoothly drilled holes in accordance with the bolt manufacturer's installation instructions. Expansion bolts shall be installed so that the load acts on the bolts in shear and withdrawal. Expansion bolts shall be carefully located in order to eliminate the risk of damage to concrete, steel reinforcement, and other embedded items.
- D. Bolted connections shall be retightened before final acceptance or, in the case of bolted connections in concealed locations, immediately before the area is sealed off.
- E. Installation of drilled anchors into post-tensioned decks will not permitted.

END OF SECTION 20 20 13